

# A High Efficiency 400W GaN Amplifier for X-Band Radar Remote Sensing Using >50 VDC FETs, Phase I

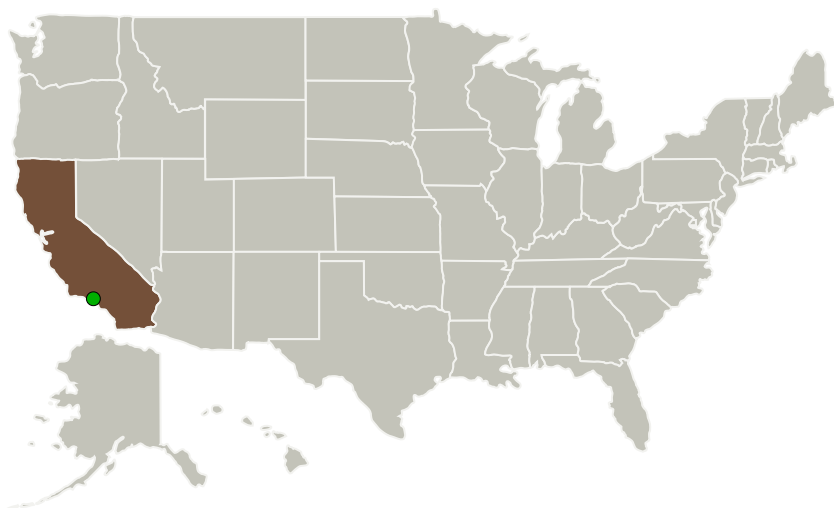
Completed Technology Project (2017 - 2017)



## Project Introduction

An efficient 400W amplifier for pulse spaceborne radar active remote sensing applications at X-Band will be investigated. Current X-band radar transmitters use TWT devices requiring kV bulky power supplies, or 0.25  $\mu\text{m}$  GaN solid-state devices operating at 28 V or 50 V at most, with 40 V typical upper limit. Solid-state technology is desirable for its better SWaP figure of merit. However, achieving 400 W at X-band with 28 V or 50 V GaN technology requires power combining of several low-power MMIC or internally-matched 50 Ohm devices. Combiners require space and introduce losses. Integra Technologies proposes a new 400 W X-band GaN amplifier that operates using 0.25  $\mu\text{m}$  GaN FETs at 75 V and possibly at 100 VDC with 30% duty cycle and >50 MHz bandwidth and achieves >40% power-added efficiency. The preliminary effort will investigate Integra's 0.25  $\mu\text{m}$  GaN devices operating at 50 V and 75 V for a  $\sim$ 50 W output power to determine gain and efficiency at X-band using Class J matching techniques for enhanced drain efficiency. Longer term device investigation will include geometry and epi modifications to optimize the chip size and cell dimensions for 100 VDC operation at X-band; a 2-stage module will target 400 W peak power and an appropriate driver device. The final amplifier module will include bias modulation techniques for efficiency. The amplifier will include material selections and layout techniques for reliability under high RF energy signal levels and low pressure environments

## Primary U.S. Work Locations and Key Partners



**Integra**  
TECHNOLOGIES, INC.

A High Efficiency 400W GaN Amplifier for X-Band Radar Remote Sensing Using >50 VDC FETs, Phase I Briefing Chart Image

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Organizations Performing Work	Role	Type	Location
Integra Technologies, Inc.	Lead Organization	Industry	El Segundo, California
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

## Primary U.S. Work Locations

California

## Images



### Briefing Chart Image

A High Efficiency 400W GaN Amplifier for X-Band Radar Remote Sensing Using >50 VDC FETs, Phase I Briefing Chart Image  
(<https://techport.nasa.gov/image/129190>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Integra Technologies, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

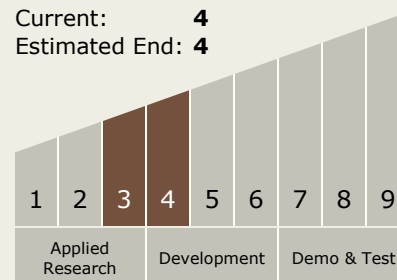
Carlos Torrez

### Principal Investigator:

Gabriele Formicone

## Technology Maturity (TRL)

Start: 3  
Current: 4  
Estimated End: 4



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## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

## Target Destinations

Earth, The Moon, Others Inside the Solar System, Outside the Solar System, The Sun, Mars